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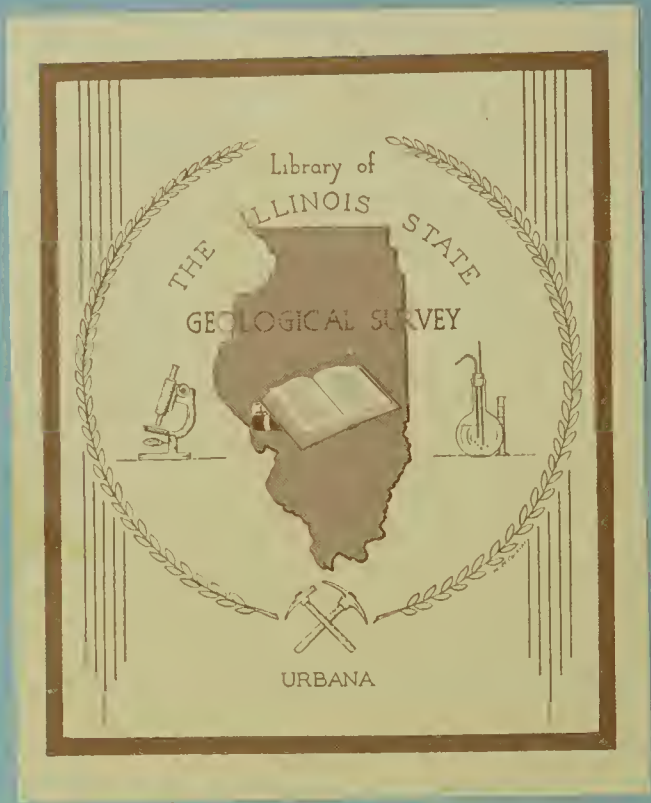
GAMMA RADIATION SURVEY OF THE GILBERTOWN AREA, ALABAMA

By William B. Collins

GEOLOGICAL SURVEY OF ALABAMA

INFORMATION SERIES 31

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GEOLOGICAL SURVEY OF ALABAMA

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THE GILBERTOWN AREA, ALABAMA**

By William B. Collins

UNIVERSITY, ALABAMA

1963

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Honorable George C. Wallace, Governor

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University, Alabama
October 1, 1963

Honorable George C. Wallace
Governor of Alabama
Montgomery, Alabama

Dear Governor Wallace:

I have the honor to transmit the manuscript of a report entitled "Gamma Radiation Survey of the Gilbertown Area, Alabama," by William B. Collins, with the request that it be printed as Information Series 31 of the Geological Survey of Alabama.

A zone of low radiation was discovered to be associated with the Gilbertown oil field, which covers a larger area than the present limits of production from the field. If associated with an accumulation of petroleum, it might possibly indicate potentialities of additional oil production in the area.

Respectfully,


Philip E. LaMoreaux
State Geologist

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GAMMA RADIATION SURVEY OF THE GILBERTOWN AREA, ALABAMA

By William B. Collins

ABSTRACT

Surface radiation data in the Gilbertown area of Choctaw County, Alabama indicate a zone of relatively low radiation intensity that approximately coincides with the area covered by the Gilbertown oil field.

Determining the significance of radiation lows from reconnaissance data is difficult, but, where sufficient geological control is available, gamma radiation surveying may prove to be a useful tool for oil exploration and for planning development drilling.

INTRODUCTION

LOCATION AND GEOLOGIC SETTING

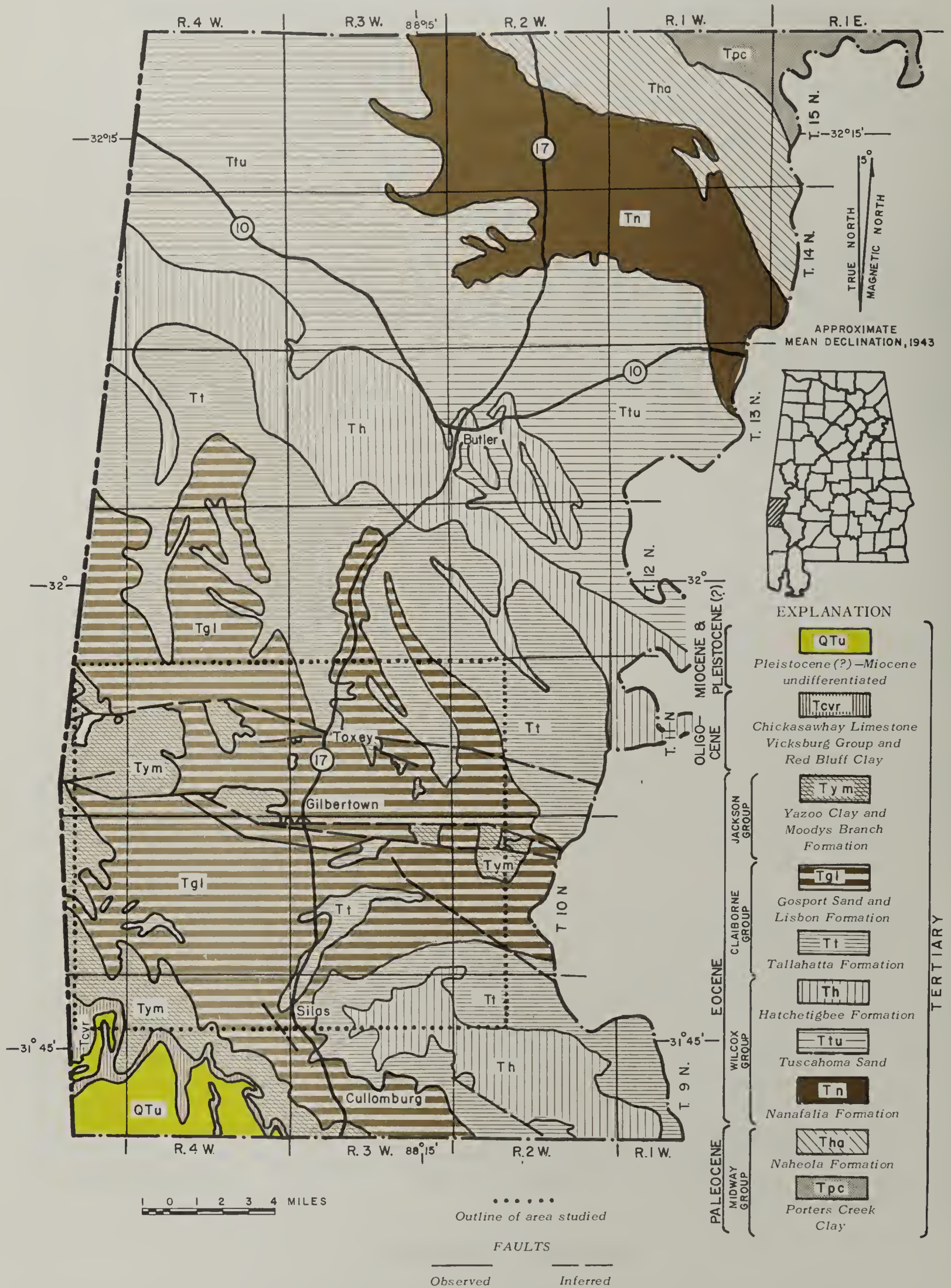
The Gilbertown area covered by this report is in Choctaw County, Alabama in T. 9 - 11 N., R. 2 - 5 W. (fig. 1). Choctaw County is in the Gulf Coastal Plain, and the outcropping formations are of Tertiary age. In the northern two-thirds of the county, the Tertiary formations strike northwest and dip southwest at 30 to 50 feet per mile.

A major structural feature, the Hatchetigbee anticline, occurs in the southern one-third of the county, from Gilbertown to the south, and the attitude of the formations is affected by this structural feature. The formations exposed in the Gilbertown area are of Eocene age, and are represented by the Yazoo Clay and Moodys Branch Formation of the Jackson Group and the Gosport, Lisbon and Tallahatta Formations of the Claiborne Group (fig. 1).

The Gilbertown oil field, discovered in 1944, which produces from fault-closure and fractures associated with faulting, is located immediately north of the Hatchetigbee anticline. The field is 13 miles long and less than 1 mile wide. It has been described as being on the north flank of the Hatchetigbee anticline (Toulmin and others, 1951); more recent data, however, indicate that the Gilbertown structure and the Hatchetigbee anticline are separate features. The fault zone which serves to trap the oil in the Gilbertown field represents the south flank of an east-west trending graben system. Vertical displacement ranges from less than 200 feet in the shallow beds to as much as 1000 feet in the deeper beds. Oil production is from fractures in the upper part of the Selma Group at a depth of about 2500 feet below land surface and from the sands in the Eutaw Formation at about 3300 feet. Both units are of Late Cretaceous age.

PURPOSE OF INVESTIGATION

The purpose of this investigation was to evaluate gamma-radiation equipment and their use in locating and delineating accumulations of oil and gas.



Modified from L. D. Toulmin and P. E. LaMoreaux (1951)

Figure 1.—Geologic map of Choctaw County, Alabama.

The Gilberttown area was selected for study because it was an area where oil production is associated with faulting and where a substantial amount of geologic information was available.

THEORY OF RADIATION SURVEYING

It has been known for many years that radioactive matter exists in the lithosphere and the atmosphere. Investigations have been made only recently, however, of the variations in intensity of the radiation emitted by the earth. In the early 1930's, efforts were made to relate certain surface-radioactivity variations to the accumulation of hydrocarbons at depth, but it wasn't until about 1940 that radiation surveying was seriously investigated as a technique for oil exploration. Considerable work has been done since 1940 to improve instrumentation, field techniques, and interpretation methods.

Many theories have been advanced to explain radioactivity anomalies at the earth's surface that might be associated with the occurrence of petroleum in the subsurface. One of the more plausible theories to the writer is a phenomenon known as "photodisintegration," a process where a series of radioactive inducements and subsequent reemissions might originate at depth and eventually reach the surface (Crews, 1959).

Radiation intensity recorded in a surface survey over an accumulation of oil or gas will vary in character or shape, depending on the geologic structure. Radiation anomalies were divided by Crews (1961) into the following general classes: class 1, associated with reservoirs having faults as their limits; class 2, generally associated with reefs or pronounced facies changes; class 3, associated with stratigraphic traps (fig. 2). The recorded data may represent a combination of two or more of the above general classes. Another type of anomaly is believed associated with subsurface faulting (Williams and Lorenz, 1957). See figure 3.

ACKNOWLEDGMENTS

Acknowledgment is made to W. D. Crews of Exploration Unlimited, Inc., Tulsa, Oklahoma, and to Dean Miller of Southern States Oil Company, Jackson, Mississippi, for their suggestions and encouragement.

EQUIPMENT

A battery powered portable geiger unit was used in this study. Two to five specially constructed geiger tubes, each having a sensitivity of 500,000 counts per minute in milliroentgens per hour, may be used in the detector depending on the desired sensitivity. These tubes have a high efficiency for detecting gamma radiation. In this study, three tubes were used in the detector with a combined sensitivity of 1.5×10^6 counts per minute in milliroentgens per hour.

The data were graphically recorded by an instrument geared externally to the speedometer cable of a vehicle, at a scale of 2 inches equal 1 mile. The

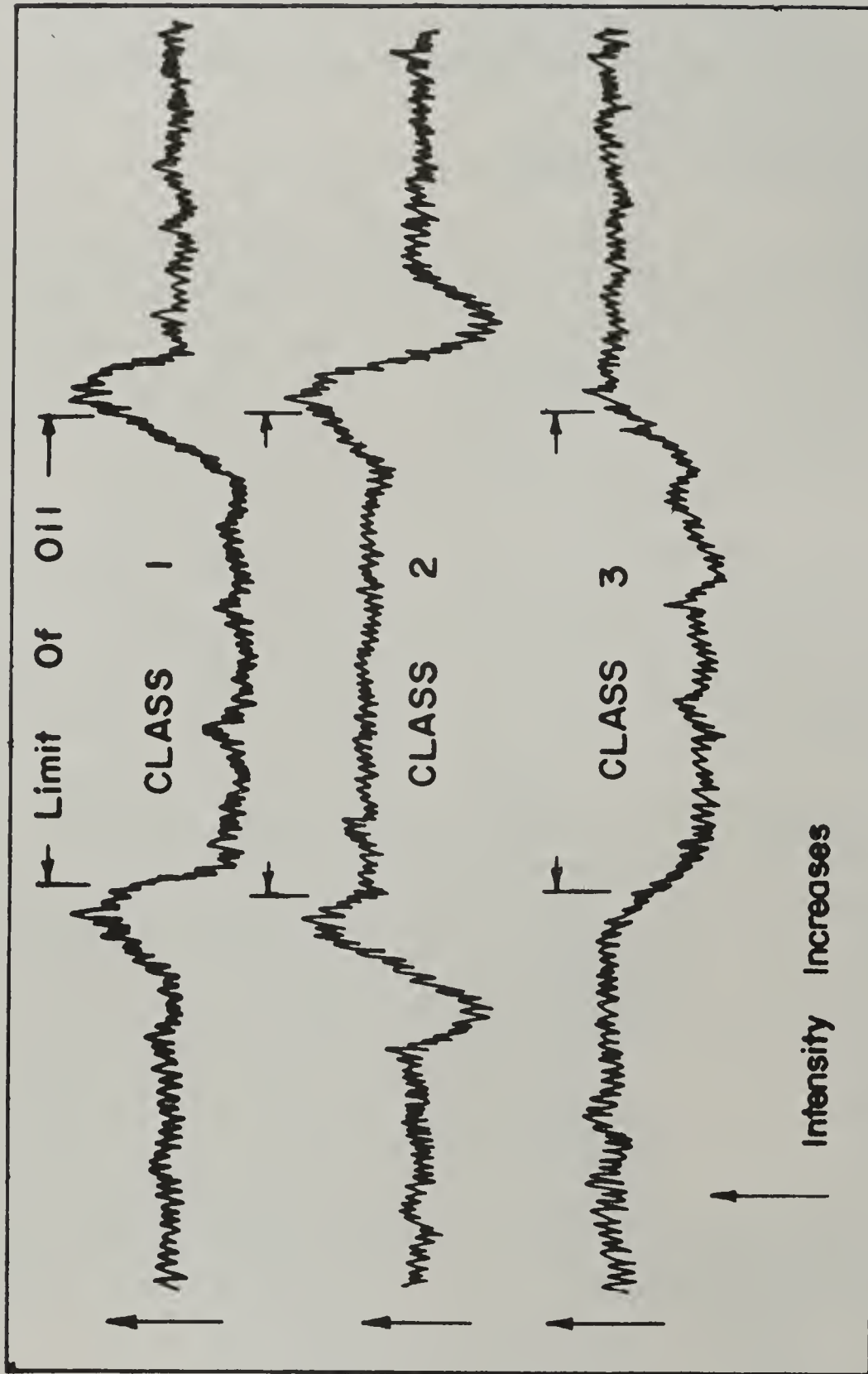


Figure 2.—Idealized character of surface recordings for different types of oil traps.

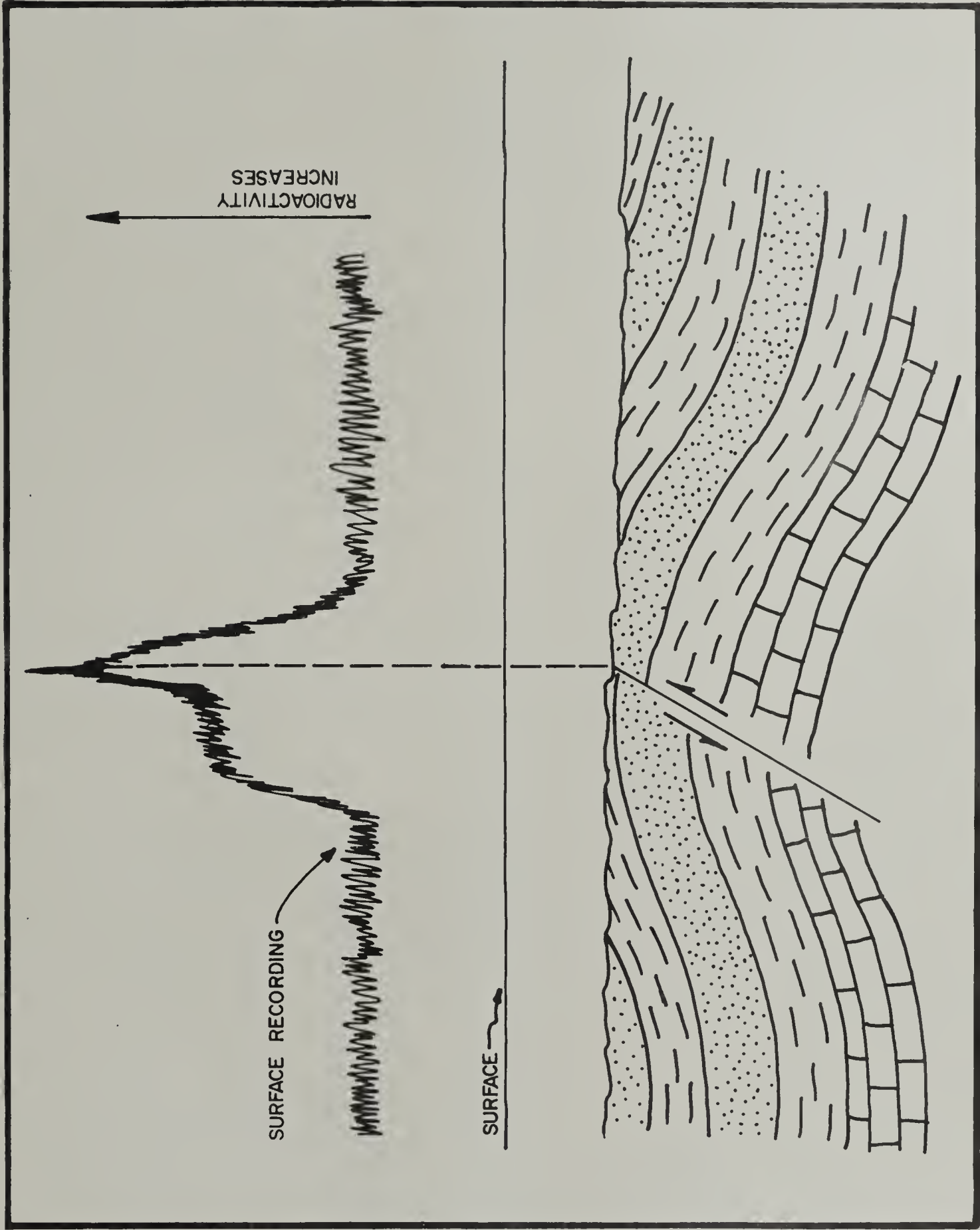


Figure 3.—Characteristic radiation curve for a subsurface fault.

equipment used and the field surveying unit are shown in figures 4 and 5.

SURVEYING METHODS AND INTERPRETATION

FIELD PROCEDURE

A series of continuous traverses were made along roads in the area to cover the Gilberttown oil field (pl. 1). The detector case containing the multiplier tubes was mounted on the rear seat of the vehicle, with the sensing area of each tube about $2\frac{1}{2}$ feet above land surface. Readings were recorded at a scale of 5000 counts per minute, with a 0.5 second time response. Shielding apparatus or electrical circuitry for background suppression was not used. Continuously-recorded data were obtained on at least two traverses over each road included in the study (pl. 1) at a predetermined, optimum recording speed of 10 miles per hour. Compensations for drift (instrument and background variations) were made comparing the intensities at a single point obtained at the beginning and conclusion of each traverse.

INTERPRETATION

Variations in radiation intensity could be caused by: changes in atmospheric conditions; manmade structures, such as roads and bridges; radioactive fallout from nuclear tests; changes in the composition of the surface soil; and the speed of the surveying vehicle. Field conditions were carefully recorded to aid in the interpretation of the data. Some of the effects of different types of roads and bridges are shown in figure 6.

Low and high radiation intensities were determined along each traverse relative to an average or base level for the traverse (fig. 7). The relative intensity of radiation varied in repeated traverses over the same road; however, the high and low zones occurred at the same places. The zone of low radiation intensity associated with the Gilberttown oil field is shown in plate 1. Radiation data and a profile of the geology along State Highway 17 southward from the town of Toxey to Souwilpa Creek are shown also in plate 1.

SUMMARY

A zone of low radiation is associated with the Gilberttown oil field, but it covers an area somewhat larger than the present limits of production from the field. If associated with an accumulation of petroleum, it might possibly indicate potentialities of additional oil production in the area.

A characteristic radiation pattern was not associated with the fault system, which is the north boundary of the oil field. This may be caused by the many faults in the system and the associated fracturing.

The data obtained in this study were not adequate to indicate the value of radiation surveying as a technique in the exploration for petroleum. It

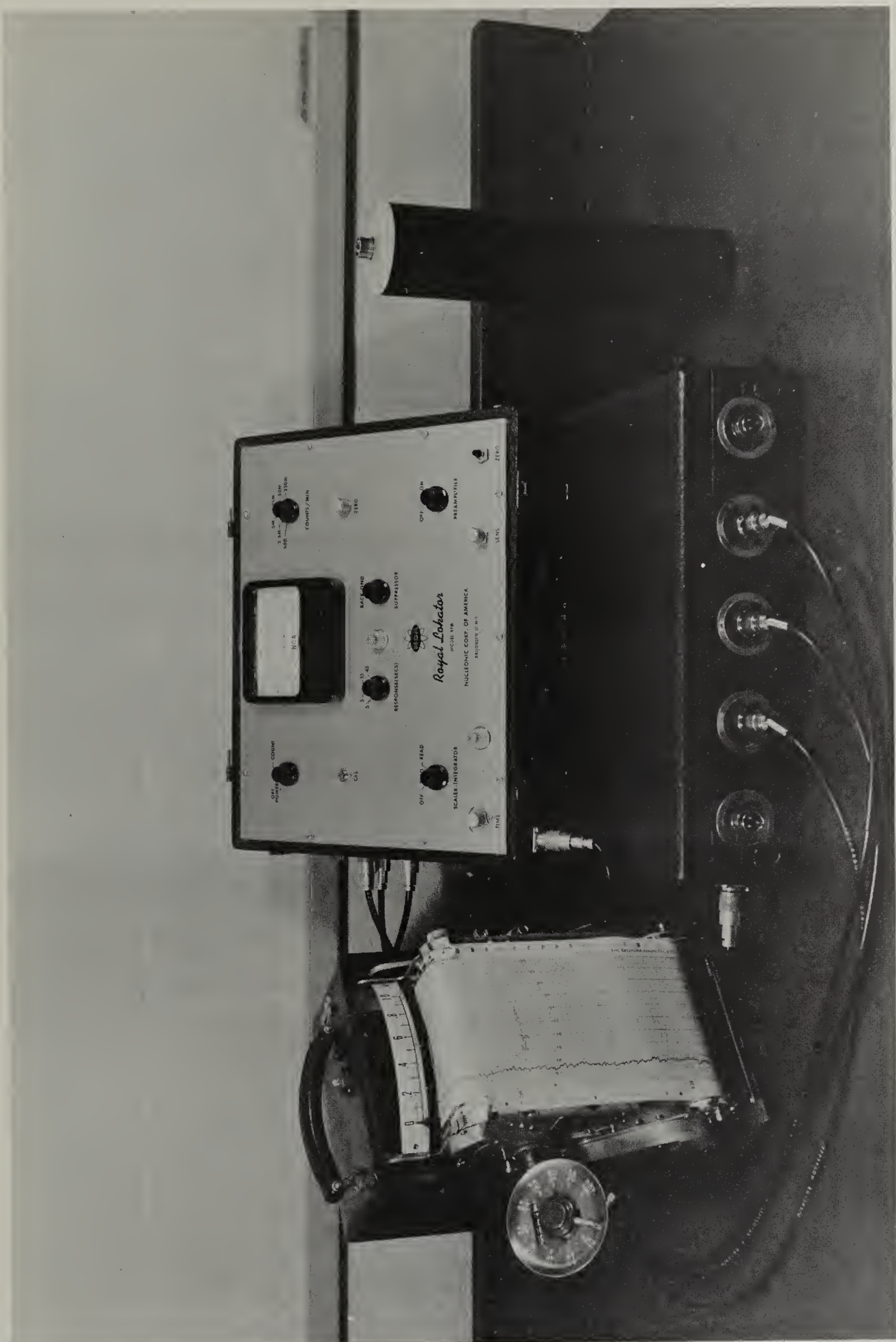


Figure 4.—Instruments.

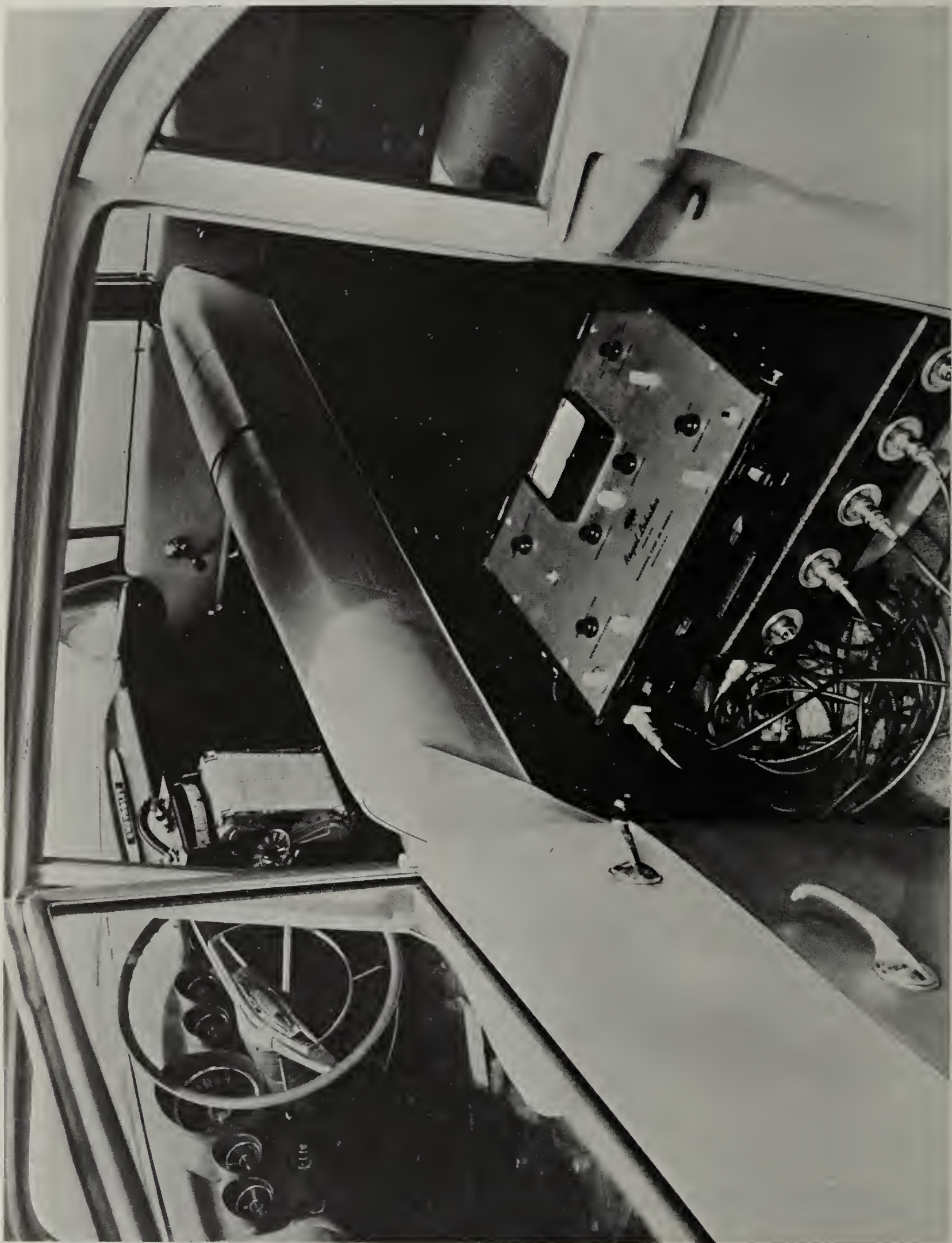


Figure 5.—Field surveying unit.

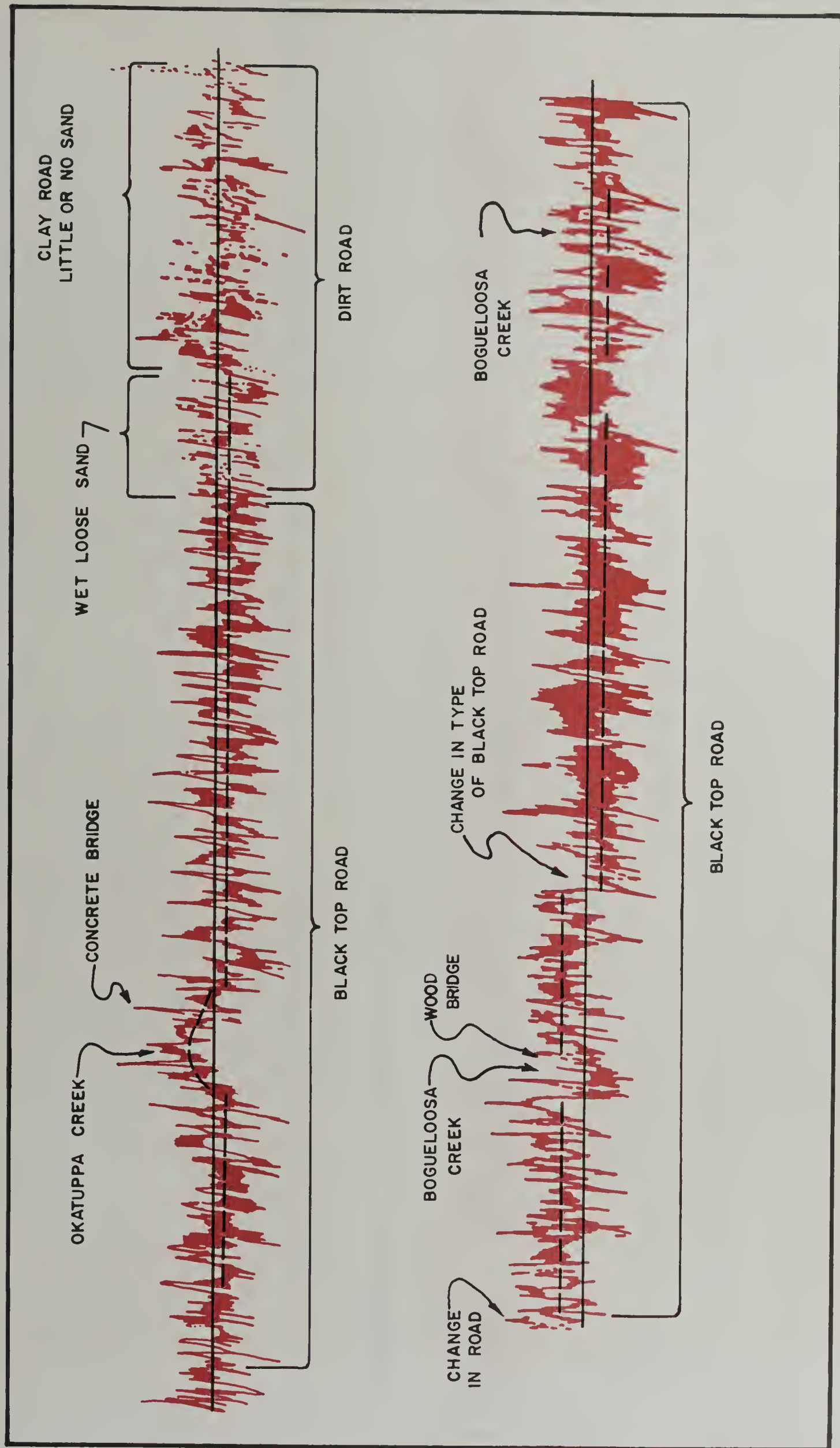


Figure 6.—Effects of manmade structures on radiation intensities.

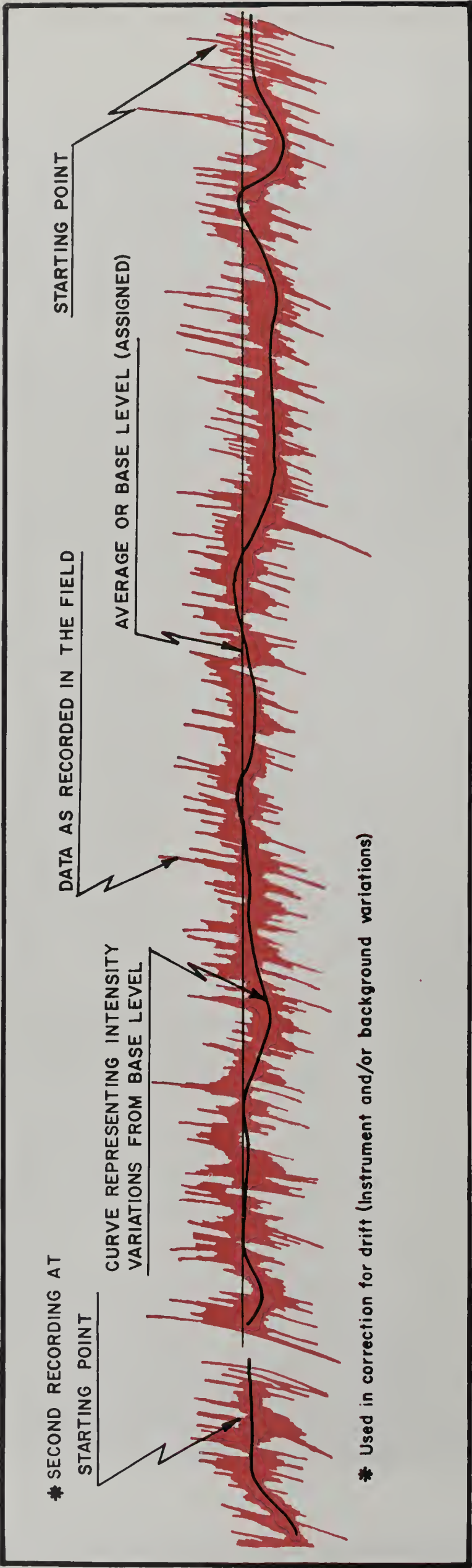
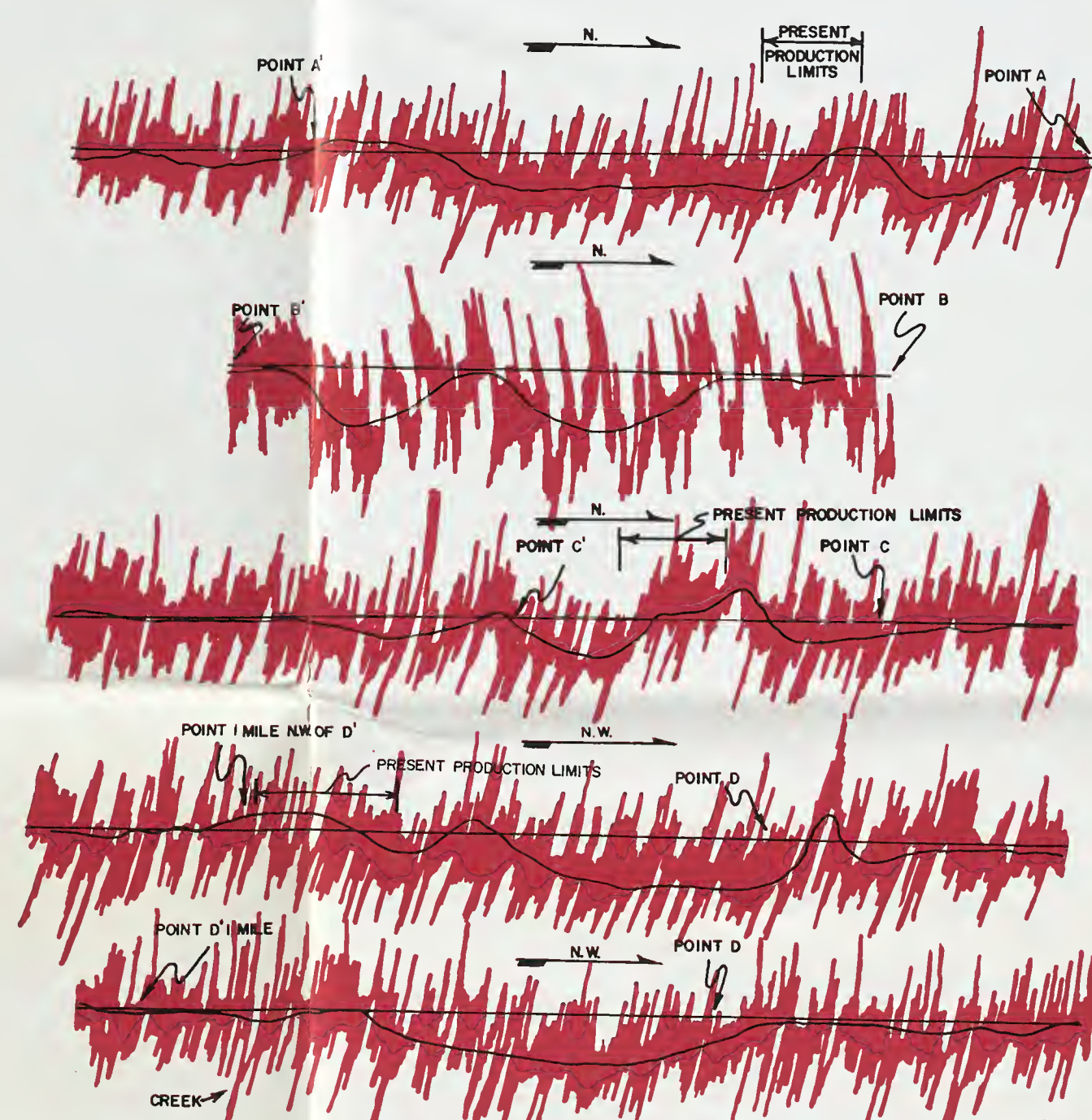
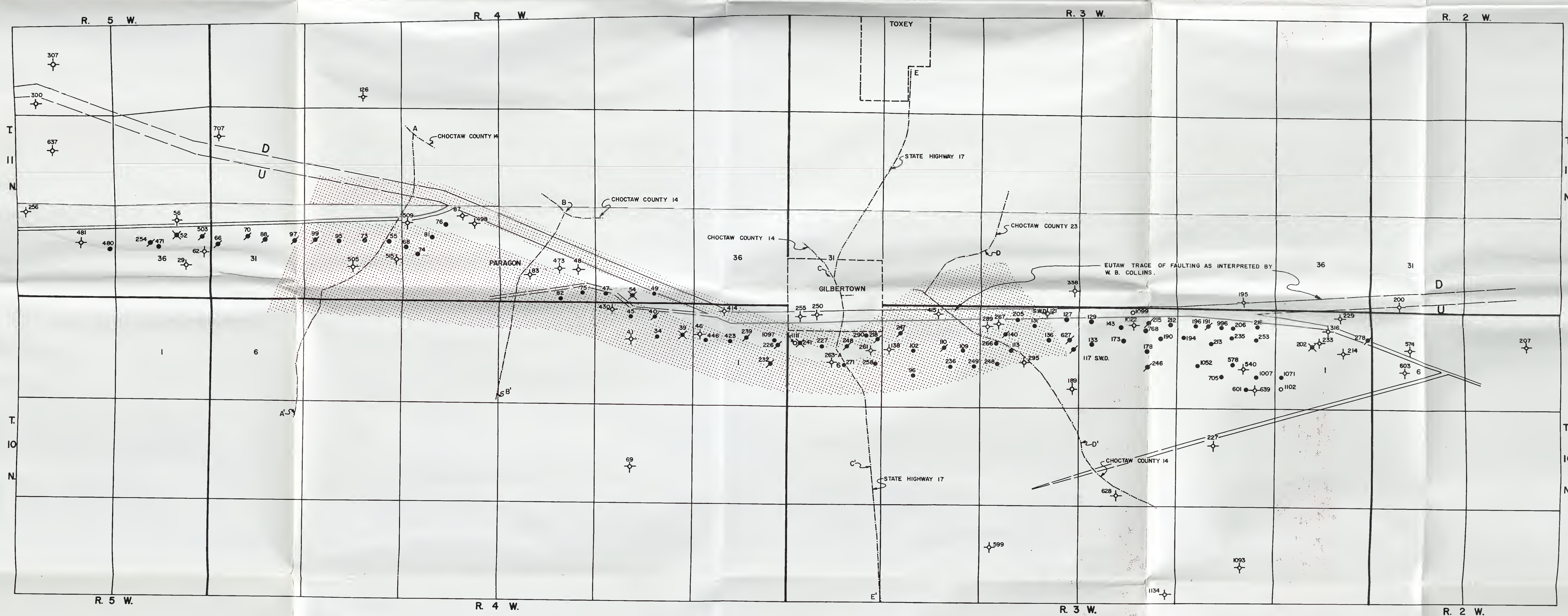
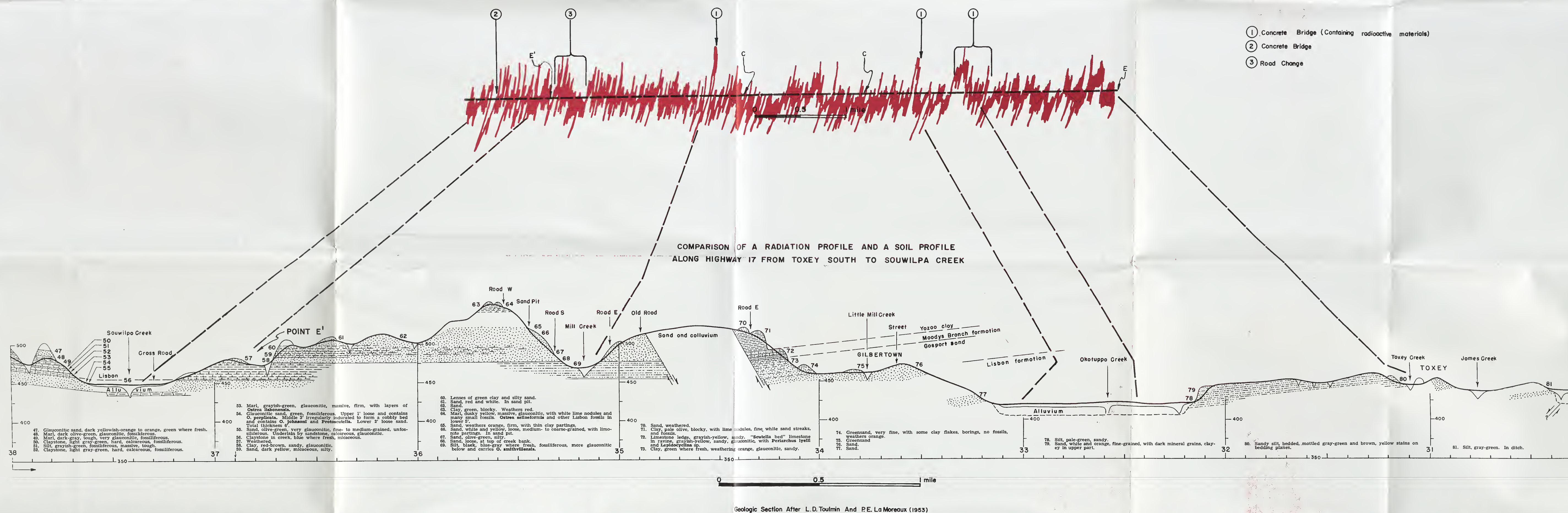


Figure 7.—Radiation profile illustrating data used in interpretation.

is encouraging, however, that a zone of low radiation intensity was associated with the Gilbertown oil field. Without quantitatively considering the variation of radioactivity owing to the effect of changes in atmospheric conditions, manmade structures, radioactive fallout, changes in surface soil, and the speed of the surveying vehicle, the zone of low radiation intensity would probably not have been detected if the boundaries of the Gilbertown oil field had not been known.

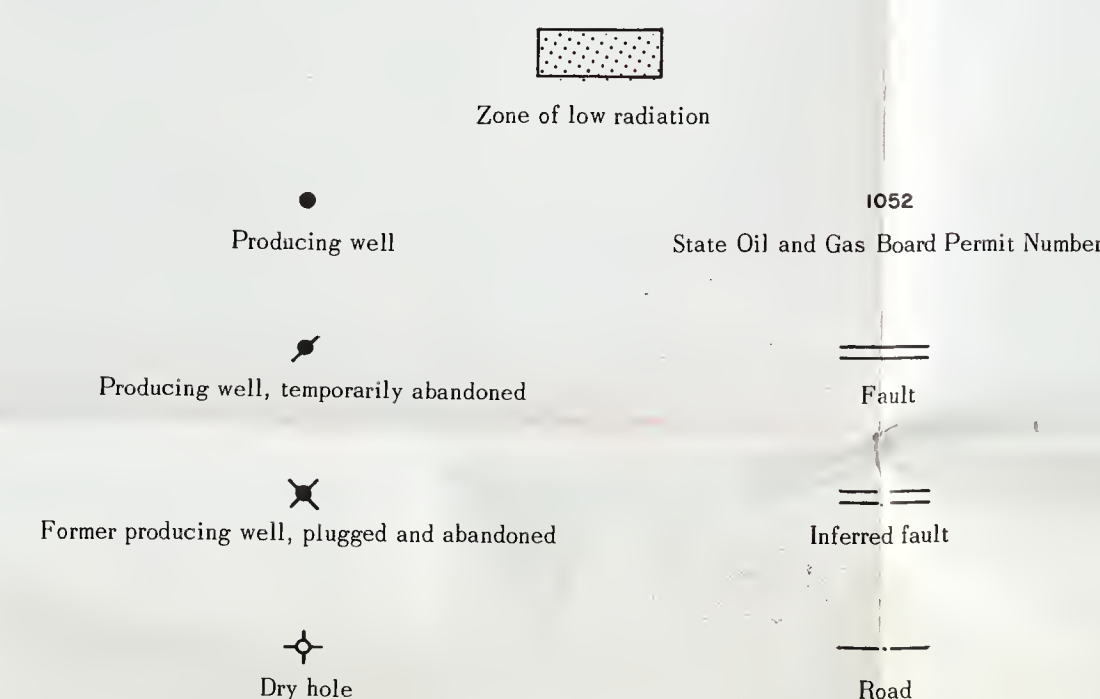
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PROFILES ACROSS THE GILBERTOWN FIELD

EXPLANATION



MAP OF GILBERTOWN OIL FIELD SHOWING RADIATION LINES WHICH CROSS THE FIELD AND ZONE OF LOW RADIATION ASSOCIATED WITH THE FIELD

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